# General

## Guideline Title

Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management.

## Bibliographic Source(s)

American Society of Anesthesiologists Task Force on Perioperative Blood Management. Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management. Anesthesiology. 2015 Feb;122(2):241-75. [277 references] PubMed

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Practice guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Anesthesiology. 2006 Jul;105(1):198-208.

This guideline meets NGC's 2013 (revised) inclusion criteria.

# Regulatory Alert

## FDA Warning/Regulatory Alert

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- December 14, 2016 – General anesthetic and sedation drugs : The U.S. Food and Drug Administration (FDA) is warning that repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than 3 years or in pregnant women during their third trimester may affect the development of children's brains. Consistent with animal studies, recent human studies suggest that a single, relatively short exposure to general anesthetic and sedation drugs in infants or toddlers is unlikely to have negative effects on behavior or learning. However, further research is needed to fully characterize how early life anesthetic exposure affects children's brain development.

# Recommendations

## Major Recommendations

## Major Recommendations

Summary of Recommendations

I. Patient Evaluation
- Review previous medical records and interview the patient or family to identify
  - Previous blood transfusion
  - History of drug-induced coagulopathy (e.g., warfarin, clopidogrel, aspirin and other anticoagulants, as well as vitamins or herbal supplements that may affect coagulation [see Appendix 3 in the original guideline document])
  - The presence of congenital coagulopathy
  - History of thrombotic events (e.g., deep vein thrombosis, pulmonary embolism)
  - Risk factors for organ ischemia (e.g., cardiorespiratory disease) which may influence the ultimate transfusion trigger for red blood cells (e.g., hemoglobin level)
- Inform patients of the potential risks versus benefits of blood transfusion and elicit their preferences.
- Review available laboratory test results including hemoglobin, hematocrit, and coagulation profiles.
- Order additional laboratory tests depending on a patient's medical condition (e.g., coagulopathy, anemia).
- Conduct a physical examination of the patient (e.g., ecchymosis, petechiae, pallor).
- If possible, perform the preoperative evaluation well enough in advance (e.g., several days to weeks) to allow for proper patient preparation.

II. Preadmission Patient Preparation
- Erythropoietin with or without iron may be administered when possible to reduce the need for allogeneic blood in selected patient populations (e.g., renal insufficiency, anemia of chronic disease, refusal of transfusion).‡‡‡‡
- Administer iron to patients with iron deficiency anemia if time permits.
- In consultation with an appropriate specialist, discontinue anticoagulation therapy (e.g., warfarin, anti-Xa drugs, antithrombin agents) for elective surgery.
  - Transition to a shorter acting drug (e.g., heparin, low-molecular-weight heparin) may be appropriate in selected patients.
- If clinically possible, discontinue nonaspirin antiplatelet agents (e.g., thienopyridines such as clopidogrel, ticagrelor, or prasugrel) for a sufficient time in advance of surgery, except for patients with a history of percutaneous coronary interventions.§§§§
  - Aspirin may be continued on a case-by-case basis.
- The risk of thrombosis versus the risk of increased bleeding should be considered when altering anticoagulation status.
- Assure that blood and blood components are available for patients when significant blood loss or transfusion is expected.
- When autologous blood is preferred, the patient may be offered the opportunity to donate blood before admission only if there is adequate time for erythropoietic reconstitution.||

III. Preprocedure Preparation

*Blood Management Protocols*

- Multimodal protocols or algorithms may be employed as strategies to reduce the usage of blood products. However, no single algorithm or protocol can be recommended at this time.
- A restrictive red blood cell transfusion strategy may be safely used to reduce transfusion administration.***
  - The determination of whether hemoglobin concentrations between 6 and 10 g/dl justify or require red blood cell transfusion should be based on potential or actual ongoing bleeding (rate and magnitude), intravascular volume status, signs of organ ischemia, and adequacy of cardiopulmonary reserve.
  - Red blood cells should be administered unit-by-unit, when possible, with interval reevaluation.
- A protocol for avoidance of transfusion may be used as a strategy to reduce blood loss for patients in whom transfusion is refused or is not possible.
- A massive (i.e., hemorrhagic) transfusion protocol may be used when available as a strategy to optimize the delivery of blood products to massively bleeding patients.
- Use a maximal surgical blood order schedule, when available and in accordance with your institutional policy, as a strategy to improve the efficiency of blood ordering practices.

*Reversal of Anticoagulants*

- For urgent reversal of warfarin, administer prothrombin complex concentrates (PCCs) in consultation with the appropriate specialist, or administer fresh-frozen plasma (FFP).
- Administer vitamin K for selected patients for nonurgent reversal of warfarin, except when rapid restoration of anti-coagulation after surgery is required.

*Antifibrinolytics for Prophylaxis of Excessive Blood Loss*

- Use antifibrinolytic therapy for prophylaxis of the use of allogeneic blood transfusion in patients undergoing cardiopulmonary bypass.
- Consider using antifibrinolytic therapy for prophylaxis in certain orthopedic surgery.
- Consider using antifibrinolytic therapy for prophylaxis in liver surgery and other clinical circumstances at high-risk for excessive bleeding.†††

*Acute Normovolemic Hemodilution (ANH)*

- Consider ANH to reduce allogeneic blood transfusion in patients at high-risk for excessive bleeding (e.g., major cardiac, orthopedic, thoracic, or liver surgery), if possible.‡‡‡

IV. Intraoperative and Postoperative Management of Blood Loss

*Allogeneic Red Blood Cell Transfusion*

- Administer blood without consideration of duration of storage.
- Leukocyte-reduced blood may be used for transfusion for the purpose of reducing complications associated with allogeneic blood transfusion.

*Reinfusion of Recovered Red Blood Cells*

- Reinfuse recovered red blood cells as a blood-sparing intervention in the intraoperative period, when appropriate.

*Intraoperative and Postoperative Patient Monitoring*

- Periodically conduct a visual assessment of the surgical field jointly with the surgeon to assess the presence of excessive microvascular (i.e., coagulopathy) or surgical bleeding.
- Use standard methods for quantitative measurement of blood loss, including checking suction canisters, surgical sponges, and surgical drains.
- Monitor for perfusion of vital organs using standard American Society of Anesthesiologists (ASA) monitors (i.e., blood pressure, heart rate, oxygen saturation, electrocardiography) in addition to observing clinical symptoms and physical exam features.|||
    - Additional monitoring may include echocardiography, renal monitoring (urine output), cerebral monitoring (i.e., cerebral oximetry and near infrared spectroscopy [NIRS]), analysis of arterial blood gasses, and mixed venous oxygen saturation.
- If anemia is suspected, monitor hemoglobin/hematocrit values based on estimated blood loss and clinical signs.
- If coagulopathy is suspected, obtain standard coagulation tests (e.g., international normalized ratio [INR], activated partial thromboplastin time [aPTT], fibrinogen concentration) or viscoelastic assays (e.g., thromboelastography [TEG] and rotational thromboelastometry [ROTEM]), if available, as well as platelet count.
- During and after transfusion, periodically check for signs of a transfusion reaction including hyperthermia, hemoglobinuria, microvascular bleeding, hypoxemia, respiratory distress, increased peak airway pressure, urticaria, hypotension and signs of hypocalcemia.
    - If signs of a transfusion reaction are apparent, immediately stop the transfusion, give supportive therapy, and initiate supportive care.
    - Notify the blood bank of the transfusion reaction case.

*Treatment of Excessive Bleeding*

- In patients with excessive bleeding, the following recommendations are made based upon the evidence for each of these interventions when studied singly or when compared with placebo. The impact of combinations of these interventions is not addressed in the original guideline document.
    - Obtain a platelet count before transfusion of platelets, if possible (see Table 1 in the original guideline document for suggested transfusion criteria for platelets).### In addition, obtain a test of platelet function, if available, in patients with suspected or drug-induced (e.g., clopidogrel) platelet dysfunction.
    - Obtain coagulation tests (i.e., prothrombin time [PT] or INR and aPTT) before transfusion of FFP, if possible (see Table 1 in the original guideline document for suggested transfusion criteria for FFP).****
    - Assess fibrinogen levels before the administration of cryoprecipitate, if possible (see Table 1 in the original guideline document for suggested transfusion criteria for cryoprecipitate).
    - Desmopressin may be used in patients with excessive bleeding and platelet dysfunction.
    - Consider topical hemostatics such as fibrin glue or thrombin gel.
    - Consider the use of antifibrinolytics (i.e., ε-aminocaproic acid, tranexamic acid) if fibrinolysis is documented or suspected and if these agents are not already being used.
    - PCCs may be used in patients with excessive bleeding and increased INR.
    - Consider recombinant activated factor VII when traditional options for treating excessive bleeding due to coagulopathy have been exhausted.††††

- Fibrinogen concentrate may be used.

‡‡‡‡The Task Force recognizes that erythropoietin administration is perceived as being expensive and requires time (in weeks) to induce a significant increase in hemoglobin concentration.

§§§§The Task Force cautions that clopidogrel and aspirin should not be stopped before surgery in patients with coronary stents placed in the last 3 months for bare metal stents and 1 year for drug eluting stents due to the risk of perioperative myocardial infarction. See American Society of Anesthesiologists Committee on Standards and Practice Parameters: Practice alert for the perioperative management of patients with coronary artery stents: A report by the Committee on Standards and Practice Parameters. Anesthesiology 2009; 110:22–3.

‖The Task Force cautions that preadmission blood donation may induce preoperative anemia, increase total intraoperative (autologous or allogeneic) transfusions, and increase costs.

***Red blood cells refers to all red blood cell containing components. Transfusion of red blood cells is rarely necessary when the hemoglobin concentration is more than 10 g/dl.

†††The safety of antifibrinolytics has not been established in hypercoagulable patients (e.g., pregnancy).

‡‡‡ANH may not be possible due to pre-existing patient factors such as small blood volume, low hemoglobin, or presence of ischemic disease.

‖‖American Society of Anesthesiologists: Standards for Basic Anesthetic Monitoring (last amended October 20, 2010; effective date July 1, 2011).

###A platelet count is not necessary when a massive transfusion protocol is used.

****Coagulation tests are not necessary when a massive transfusion protocol is used.

††††The Task Force cautions that there may be a risk of arterial thrombosis with the use of activated factor VII that can result in a myocardial infarction, especially in older patients.

## Clinical Algorithm(s)

None provided

# Scope

## Disease/Condition(s)

Diseases or conditions requiring surgery or other invasive procedures in which significant blood loss occurs or is expected

## Guideline Category

Evaluation

Management

Treatment

## Clinical Specialty

Anesthesiology

Cardiology

Critical Care

Emergency Medicine

Hematology

Internal Medicine

Obstetrics and Gynecology

Surgery

## Intended Users

Advanced Practice Nurses

Hospitals

Nurses

Physician Assistants

Physicians

## Guideline Objective(s)

To improve the perioperative management of blood transfusion and adjuvant therapies and to reduce the risk of adverse outcomes associated with transfusions, bleeding, or anemia

## Target Population

Patients undergoing surgery or other invasive procedures in which significant blood loss occurs or is expected. This includes but is not limited to:

- Patients undergoing cardiopulmonary bypass or cardiac surgery, urgent or emergent procedures, obstetric procedures, organ transplantation, and major noncardiac surgery
- Patients with pre-existing blood disorders or acquired coagulation deficiency
- Critically ill patients undergoing surgical or other interventional procedures
- Patients who elect not to undergo perioperative transfusion

Note: Excluded from the focus of these Guidelines are neonates, infants, children weighing less than 35 kg, and patients who are not undergoing procedures.

## Interventions and Practices Considered

Preoperative Evaluation

1. Review of previous medical records and patient/family interview
2. Review of laboratory test results
3. Patient education on benefits/risks of blood transfusions
4. Physical examination
5. Additional laboratory tests depending on a patient's medical condition (e.g., coagulopathy, anemia)

Preoperative Preparation

1. Erythropoietin with or without iron
2. Iron (for patients with iron deficiency anemia)
3. Discontinuation of anticoagulation therapy and nonaspirin antiplatelet agents (e.g., thienopyridines such as clopidogrel, ticagrelor, or prasugrel)
4. Consideration of the risk of thrombosis versus the risk of increased bleeding
5. Assurance that blood and blood components are available
6. Offering patients the opportunity to donate blood if possible
7. Multimodal protocols or algorithms
8. Restrictive red blood cell transfusion strategy
9. Protocol for avoidance of transfusion
10. Massive (i.e., hemorrhagic) transfusion protocol
11. Maximal surgical blood order schedule
12. Reversal of anticoagulants (prothrombin complex concentrates [PCCs] and vitamin K)
13. Antifibrinolytic therapy for prophylaxis
14. Acute normovolemic hemodilution (ANH)

Intraoperative and Postoperative Management of Blood Loss and Transfusions

1. Allogeneic red blood cell transfusion
2. Reinfusion of recovered red blood cells
3. Intraoperative and postoperative patient monitoring
    - Visual assessment
    - Standard methods for quantitative measurement of blood loss
    - Perfusion of vital organs using standard American Society of Anesthesiologists (ASA) monitors
    - Hemoglobin/hematocrit values
    - Coagulation tests
    - Signs of a transfusion reaction
4. Treatment of excessive bleeding
    - Platelet count, coagulation tests and assessment of fibrinogen levels
    - Desmopressin
    - Topical hemostatics
    - Antifibrinolytics (i.e., É›-aminocaproic acid, tranexamic acid)
    - PCCs
    - Recombinant activated factor VII
    - Fibrinogen concentrate

## Major Outcomes Considered

Number of patients transfused in major surgical procedures
Blood loss
Volume of allogeneic blood transfused
Adverse outcomes of transfusion
Efficacy of intraoperative or postoperative monitoring procedures

# Methodology

## Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

## Description of Methods Used to Collect/Select the Evidence

Scientific evidence used in the development of these updated Guidelines is based on cumulative findings from literature published in peer-reviewed journals. Literature citations are obtained from PubMed and other healthcare databases, direct internet searches, Task Force members, liaisons with other organizations and from manual searches of references located in reviewed articles.

State of the Literature

For these updated Guidelines, a review of studies used in the development of the previous update was combined with studies published subsequent to approval of the update in 2005. The scientific assessment of these Guidelines was based on evidence linkages or statements regarding potential relationships between clinical interventions and outcomes. The interventions listed in Appendix 2 of the original guideline document were examined to assess their relationship to a variety of outcomes related to the perioperative blood transfusion and adjuvant therapies.

For the literature review, potentially relevant clinical studies were identified via electronic and manual searches of the literature. The updated searches covered an 11-yr period from 2004 to 2014. Over 1800 new citations that addressed topics related to the evidence linkages were

identified. These articles were reviewed and those meeting the appropriate criteria as outlined in the "Focus" section in the original guideline document were combined with pre-2005 articles used in the previous update, resulting in a total of 520 articles that contained direct linkage-related evidence. A complete bibliography used to develop these Guidelines, organized by section, is available (see the "Availability of Companion Documents" field).

## Number of Source Documents

A total of 520 articles contained direct linkage-related evidence.

## Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

## Rating Scheme for the Strength of the Evidence

Scientific Evidence

Findings from the aggregated literature are reported in the text of the Guidelines by evidence category, level, and direction. Evidence categories refer specifically to the strength and quality of the *research design* of the studies. Category A evidence represents results obtained from randomized controlled trials (RCTs), and Category B evidence represents observational results obtained from non randomized study designs or RCTs without pertinent comparison groups. When available, Category A evidence is given precedence over Category B evidence in the reporting of results. These evidence categories are further divided into evidence levels. Evidence levels refer specifically to the strength and quality of the summarized study *findings* (i.e., statistical findings, type of data, and the number of studies reporting/replicating the findings) within the two evidence categories. For this document, only the highest level of evidence is included in the summary report for each intervention, including a directional designation of benefit, harm, or equivocality for each outcome.

Category A

RCTs report comparative findings between clinical interventions for specified outcomes. Statistically significant ($P < 0.01$) outcomes are designated as either beneficial (B) or harmful (H) for the patient; statistically nonsignificant findings are designated as equivocal (E).

*Level 1*: The literature contains a sufficient number of RCTs to conduct meta-analysis,* and meta-analytic findings from these aggregated studies are reported as evidence.

*Level 2*: The literature contains multiple RCTs, but the number of RCTs is not sufficient to conduct a viable meta-analysis for the purpose of these updated Guidelines. Findings from these RCTs are reported as evidence.

*Level 3*: The literature contains a single RCT, and findings from this study are reported as evidence.

Category B

Observational studies or RCTs without pertinent comparison groups may permit *inference* of beneficial or harmful relationships among clinical interventions and outcomes. Inferred findings are given a directional designation of beneficial (B), harmful (H), or equivocal (E). For studies that report statistical findings, the threshold for significance is $P<0.01$.

*Level 1*: The literature contains observational comparisons (e.g., cohort, case-control research designs) between clinical interventions for a specified outcome.

*Level 2*: The literature contains observational studies with associative statistics (e.g., relative risk, correlation, sensitivity/specificity).

*Level 3*: The literature contains noncomparative observational studies with descriptive statistics (e.g., frequencies, percentages).

*Level 4*: The literature contains case reports.

Insufficient Literature

The *lack* of sufficient scientific evidence in the literature may occur when the evidence is either unavailable (i.e., no pertinent studies found) or inadequate. Inadequate literature cannot be used to assess relationships among clinical interventions and outcomes, as such literature does not

permit a clear interpretation of findings due to methodological concerns (e.g., confounding in study design or implementation) or does not meet the criteria for content as defined in the "Focus" of the Guidelines.

Opinion-Based Evidence

All opinion-based evidence (e.g., survey data, open-forum testimony, internet-based comments, letters, and editorials relevant to each topic was considered in the development of these updated Guidelines. However, only the findings obtained from formal surveys are reported.

Opinion surveys were developed for this update by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants and a random sample of American Society of Anesthesiologists (ASA) members.

Category A: Expert Opinion

Survey responses from Task Force-appointed expert consultants are reported in summary form in the text, with a complete listing of consultant survey responses reported in Appendix 2 in the original guideline document.

Category B: Membership Opinion

Survey responses from active ASA members are reported in summary form in the text, with a complete listing of ASA member survey responses reported in Appendix 2 in the original guideline document.

Survey responses from expert and membership sources are recorded using a 5-point scale and summarized based on median values.**

*Strongly Agree*: Median score of 5 (At least 50% of the responses are 5)

*Agree*: Median score of 4 (At least 50% of the responses are 4 or 4 and 5)

*Equivocal*: Median score of 3 (At least 50% of the responses are 3, or no other response category or combination of similar categories contain at least 50% of the responses)

*Disagree*: Median score of 2 (At least 50% of responses are 2 or 1 and 2)

*Strongly Disagree*: Median score of 1 (At least 50% of responses are 1)

Category C: Informal Opinion

Open-forum testimony obtained during development of these Guidelines, Internet-based comments, letters, and editorials are all informally evaluated and discussed during the formulation of Guideline recommendations. When warranted, the Task Force may add educational information or cautionary notes based on this information.

*All meta-analyses are conducted by the ASA Committee on Standards and Practice Parameters methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document.

**When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.

## Methods Used to Analyze the Evidence

Meta-Analysis

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

Initially, each pertinent study finding was classified and summarized to determine meta-analysis potential. Literature pertaining to 11 evidence linkages contained enough studies with well-defined experimental designs and statistical information sufficient for meta-analyses. These linkages were (1) erythropoietin versus placebo, (2) ε-aminocaproic acid versus placebo; (3) tranexamic acid versus placebo administered before or during surgery, (4) acute normovolemic hemodilution (ANH) versus no ANH; (5) ANH with intraoperative red blood cell recovery versus red blood cell recovery alone, (6) restrictive versus liberal transfusion strategy, (7) intraoperative red blood cell recovery versus conventional transfusion, (8) desmopressin versus placebo, (9) tranexamic acid versus placebo administered after surgery, (10) fibrin glue versus no fibrin glue, and (11) recombinant activated factor VII versus placebo (see Table 2 in the original guideline document).

General variance-based effect-size estimates or combined probability tests were obtained for continuous outcome measures, and Mantel–Haenszel odds ratios were obtained for dichotomous outcome measures. Two combined probability tests were employed as follows: (1) the Fisher combined test, producing chi-square values based on logarithmic transformations of the reported *P* values from the independent studies, and (2) the Stouffer combined test, providing weighted representation of the studies by weighting each of the standard normal deviates by the size of the sample. An odds ratio procedure based on the Mantel–Haenszel method for combining study results using 2×2 ables was used with outcome frequency information. An acceptable significance level was set at $P<0.01$ (one-tailed). Tests for heterogeneity of the independent studies were conducted to assure consistency among the study results. DerSimonian-Laird random-effects odds ratios were obtained when significant heterogeneity was found ($P<0.01$). To control for potential publishing bias, a "fail-safe n" value was calculated. No search for unpublished studies was conducted, and no reliability tests for locating research results were done. To be accepted as significant findings, Mantel–Haenszel odds ratios must agree with combined test results whenever both types of data are assessed. In the absence of Mantel–Haenszel odds ratios, findings from both the Fisher and weighted Stouffer combined tests must agree with each other to be acceptable as significant.

For the previous update, interobserver agreement among Task Force members and two methodologists was established by inter-rater reliability testing. Agreement levels using a kappa (κ) statistic for two-rater agreement pairs were as follows: (1) type of study design, $\kappa=0.83–0.94$; (2) type of analysis, $\kappa=0.87–0.94$; (3) evidence linkage assignment, $\kappa=0.89–0.96$; and (4) literature inclusion for database, $\kappa=0.44–0.78$. Three-rater chance-corrected agreement values were: (1) study design, Sav=0.89, Var (Sav)=0.004; (2) type of analysis, Sav=0.88, Var (Sav)=0.004; (3) linkage assignment, Sav=0.92 Var (Sav)=0.002; (4) literature database inclusion, Sav=0.58 Var (Sav)=0.054. These values represent moderate to high levels of agreement.

Consensus-based Evidence

For the previous update, consensus was obtained from multiple sources, including: (1) survey opinion from consultants who were selected based on their knowledge or expertise in perioperative blood transfusion and adjuvant therapies, (2) survey opinions from a randomly selected sample of active members of the American Society of Anesthesiologists (ASA), (3) testimony from attendees of two publicly held open forums at two national anesthesia meetings,* (4) Internet commentary, and (5) Task Force opinion and interpretation. The survey rate of return was 31% (n=21 of 67) for consultants, and 29% (n=87 of 300) for membership respondents. Survey results are reported in Tables 3 and 4 in the original guideline document, and summarized in the text of the Guidelines.

For the previous update, the consultants were asked to indicate which, if any, of the evidence linkages would change their clinical practices if the Guidelines were instituted. The rate of return was 24% (n=16 of 67). The percent of responding consultants expecting *no change* associated with each linkage were as follows: preoperative evaluation—75%; discontinuation of anticoagulation and delay of surgery—94%; drugs to manage perioperative anemia—75%; drugs to promote coagulation and minimize blood loss—81%; preoperative autologous blood collection—88%; monitoring for inadequate perfusion and oxygenation—94%; monitoring for transfusion indications—88%; transfusion of allogeneic red blood cells —94%, transfusion of autologous blood— 100%; transfusion of platelets—88%; transfusion of frozen plasma—88%; transfusion of cryoprecipitate—94%; treatment of excessive bleeding—88%; and monitoring and laboratory testing for transfusion reactions—88%. Eighty-eight percent of the respondents indicated that the Guidelines would have *no effect* on the amount of time spent on a typical case. Two respondents (12%) indicated that there would be an increase in the amount of time they would spend on a typical case with the implementation of these Guidelines. The amount of increased time anticipated by these respondents was 5 and 10 min.

*36th Annual Meeting of the Society of Cardiovascular Anesthesiologists, New Orleans, Louisiana, March 31, 2014; the International Anesthesia Research Society 2014 Annual Meeting and International Science Symposium, Montreal, Quebec, Canada, May 19, 2014.

## Methods Used to Formulate the Recommendations

Expert Consensus

## Description of Methods Used to Formulate the Recommendations

Task Force Members and Consultants

In 2012, the American Society of Anesthesiologists (ASA) Committee on Standards and Practice Parameters requested that the updated Guidelines published in 2006 be re-evaluated. This current revision consists of a literature evaluation and an evaluation of new survey findings of expert consultants and ASA members. A summary of recommendations is found in Appendix 1 of the original guideline document.

This revision was developed by an ASA appointed Task Force of 10 members, consisting of anesthesiologists in both private and academic practices from various geographic areas of the United States, a pathologist specializing in transfusion medicine, and two consulting methodologists

from the ASA Committee on Standards and Practice Parameters.

The Task Force developed the Guidelines by means of a seven-step process. First, they reached consensus on the criteria for evidence of effective blood transfusion and adjuvant therapies. Second, original published research studies from peer-reviewed journals relevant to the perioperative management of patients undergoing blood transfusions were reviewed. Third, the panel of expert consultants was asked to (1) participate in opinion surveys on the effectiveness of various perioperative management strategies and (2) review and comment on a draft of the Guidelines developed by the Task Force. Fourth, opinions about the Guideline recommendations were solicited from random samples of active members of the ASA. Fifth, the Task Force held open forums at two major national meetings to solicit input on its draft recommendations*. National organizations representing specialties whose members typically care for patients undergoing perioperative transfusion were invited to participate in the open forums. Sixth, the consultants were surveyed to assess their opinions on the feasibility of implementing the Guidelines. Seventh, all available information was used to build consensus within the Task Force to finalize the Guidelines.

*36th Annual Meeting of the Society of Cardiovascular Anesthesiologists, New Orleans, Louisiana, March 31, 2014; the International Anesthesia Research Society 2014 Annual Meeting and International Science Symposium, Montreal, Quebec, Canada, May 19, 2014.

### Rating Scheme for the Strength of the Recommendations

Not applicable

### Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

### Method of Guideline Validation

Internal Peer Review

### Description of Method of Guideline Validation

The updated guideline was approved by the American Society of Anesthesiologists (ASA) House of Delegates on October 15, 2014.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence (see Appendix 2 in the original guideline document).

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Observational studies indicate that implementing a maximal surgical blood order schedule or surgical blood order equation may improve the efficiency of blood ordering practices.

### Potential Harms

- Two randomized controlled trials (RCTs) comparing the administration of aspirin with placebo before surgery report equivocal findings ($P>0.01$) for perioperative blood loss, transfusion requirements, or postoperative adverse events (e.g., myocardial infarction, major

bleeding, or death.

- The Task Force cautions that preadmission blood donation may induce preoperative anemia, increase total intraoperative (autologous or allogeneic) transfusions, and increase costs.
- The Task Force cautions that there may be a risk of arterial thrombosis with the use of activated factor VII that can result in a myocardial infarction, especially in older patients.
- Also see Appendix 4 in the original guideline document for further information on adverse effects associated with transfusion.

# Qualifying Statements

## Qualifying Statements

Practice guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open forum commentary, and clinical feasibility data.

# Implementation of the Guideline

## Description of Implementation Strategy

An implementation strategy was not provided.

# Institute of Medicine (IOM) National Healthcare Quality Report Categories

## IOM Care Need

Getting Better

Staying Healthy

## IOM Domain

Effectiveness

Safety

# Identifying Information and Availability

## Bibliographic Source(s)

American Society of Anesthesiologists Task Force on Perioperative Blood Management. Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management.

Anesthesiology. 2015 Feb;122(2):241-75. [277 references] PubMed

## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

1996 (revised 2015 Feb)

## Guideline Developer(s)

American Society of Anesthesiologists - Medical Specialty Society

## Source(s) of Funding

American Society of Anesthesiologists

## Guideline Committee

Task Force on Perioperative Blood Management

## Composition of Group That Authored the Guideline

*Task Force Members*: Jeffrey L. Apfelbaum, MD (*Committee Chair*), Chicago, Illinois; Gregory A. Nuttall, MD (*Task Force Chair*), Rochester, Minnesota; Richard T. Connis, PhD, Woodinville, Washington; Chantal R. Harrison MD, San Antonio, Texas; Ronald D. Miller, MD, San Francisco, California; David G. Nickinovich, PhD, Bellevue, Washington; Nancy A. Nussmeier, MD, Boston, Massachusetts; Andrew D. Rosenberg, MD, Roslyn Heights, New York; Linda Shore-Lesserson MD, New Hyde Park, New York; John T. Sullivan MD, MBA, Chicago, Illinois.

## Financial Disclosures/Conflicts of Interest

The authors declare no competing interests.

## Guideline Endorser(s)

Society for Obstetric Anesthesia and Perinatology - Medical Specialty Society

Society of Cardiovascular Anesthesiologists - Medical Specialty Society

Society of Critical Care Anesthesiologists - Medical Specialty Society

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Practice guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Anesthesiology. 2006 Jul;105(1):198-208.

This guideline meets NGC's 2013 (revised) inclusion criteria.

## Guideline Availability

Available from the Anesthesiology Journal Web site .

## Availability of Companion Documents

The following is available:

- Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management. Bibliography. 2015. 36 p. Available from the Anesthesiology Journal Web site .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI on February 20, 1999. The information was verified by the guideline developer on April 23, 1999. This summary was updated by ECRI on October 19, 2006. The updated information was verified by the guideline developer on October 24, 2006. This summary was updated by ECRI on January 5, 2007 following the updated FDA advisory on Trasylol (aprotinin). This summary was updated by ECRI on January 29, 2007 following the U.S. Food and Drug Administration advisory on erythropoiesis stimulating agents. This summary was updated by ECRI Institute on July 9, 2007 following the FDA advisory on erythropoiesis stimulating agents. This summary was updated by ECRI Institute on December 30, 2015. This summary was updated by ECRI Institute on February 15, 2017 following the U.S. Food and Drug Administration advisory on general anesthetic and sedation drugs.

## Copyright Statement



# Disclaimer

## NGC Disclaimer

The National Guideline Clearinghouseâ„¢ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.